DOCUMENT RESUME

ED 361 108 PS 021 674

AUTHOR Scholmerich, Axel; And Others
TITLE Behavioral Inhibition: Type or Continuum?
INSTITUTION National Inst. of Child Health and Human Development (NIH), Bethesda, Md.
PUB DATE Mar 93
NOTE 25p.; Paper presented at the Biennial Meeting of the Society for Research in Child Development (60th, New Orleans, LA, March 25-28, 1993).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Affective Measures; Attachment Behavior; *Data Analysis; Dependency (Personality); Emotional Development; *Infant Behavior; *Infants; *Inhibition; *Research Methodology
IDENTIFIERS *Continuous Variables; Discrete Variables

ABSTRACT

This study investigated whether behavioral inhibition is best conceptualized as a continuous variable or as a distinct typology with two or more subcategories. The following data were gathered on 58 infants at 5, 7, 10, and 13 months of age; physiological functioning (cardiovascular activity and salivary cortisol); emotional expressivity in response to several stimuli; maternal perception of the infant's temperament; mother-infant interaction; and, at 13 months, behavioral inhibition, attachment security, and dependency. Scatter-plots were used to determine whether the correlation between variables was produced by extreme groups or whether it appeared similar over the range of scores. Largely similar correlation patterns and few if any mean differences would suggest that inhibition is not a categorical dimension. Results revealed very little evidence supporting a discrete perspective on behavioral inhibition as measured by the laboratory procedure; rather, most evidence appeared to be compatible with a continuous perspective. (MM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
X This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

ED 361 108

Behavioral Inhibition: type or continuum?

Axel Schölmerich, Lynn Shelley, Maria P. Fracasso, & Michael E. Lamb
SSED, National Institute of Child Health and Human Development
Bethesda, MD 20814

Paper presented to the Symposium
"The developmental analysis of temperament: Discrete types or continuous traits?",
organized by Nathan Fox and Jens Asendorpf
SRCD, New Orleans, 1993

PS 021674

Introduction.

Infants tend to display a variety of reactions towards novel social and nonsocial stimuli. This has lead to the formulation of a theory of behavioral inhibition (Kagan, Reznick, Clark, & Snidman, 1984; Kagan, Reznick, & Snidman, 1988; Kagan, Snidman, & Arcus, 1992), which postulates that there are distinct types of infants characterized by distinctive patterns of responses to novel stimuli. It is unclear, however, whether we should conceptualize behavioral inhibition as a continuous variable, very much like fear or shyness, or as a distinct typology with two or more subcategories. This decision has implications for the approriateness of the statistical measures one can use in research on behavioral inhibition, as well as for the procedures employed to measure it.

One laboratory procedure developed by Kagan and his colleagues involves a series of episodes designed to elicit fear, distress, and proximity-seeking. Mother and infant enter a laboratory room equipped with a number of attractive toys at the begining of the first episode. In the second episode a stranger enters. The third

BEST COPY AVAILABLE

episode involves a confrontation with a remote-controlled robot, and the fourth episode is again characterized by free-play with only mother and infant present. The final episode consists of another stranger disguised in a colorful clown-costume, who sits down in a corner of the room and sings a song, plays with blocks, and behaves in a variety of odd ways. During each episode, the *latency to approach*, to *touch the objects*, as well as the *latency to retreat from object*, and the *amount of time spent in proximity to mother* are measured. In addition, *crying* is scored in some laboratories.

Reznick (1989) has discussed various ways of combining the scores into a summary score. Typically, this score appears as a continuous variable with acceptable distributional properties, especially a monomodal normal distribution. On theoretical grounds, however, Kagan and his coworkers argue that inhibition should be seen as a categorical rather than as a continuous variable. Therefore, the upper 15 % in samples of healthy, white, middle-class infants is designated as a group of "highly inhibited" infants. The "unihibited" group consists of the lower 20 - 30 %. Note that there is no standard cutoff-point used to determine group assignment.

In this paper, we investigate the relationships between scores on this continuous variable and scores on other (conceptually related) variables, to find out whether continuous or discrete variable perspective best fits our data.

Before we continue, let us consider what evidence might be helpful in choosing between the two perspectives. First of all, a bimodal or multimodal distribution of scores on the measure of behavioral inhibition would support the categorical character of this concept. A monomodal distrubution, however, tells us little in this respect, because the overlap of two distributions can easily create a monomodal distribution. Secondly, if we compare inhibited and uninhibited infants, we would expect to find mean differences on external variables, especially if those variables are theoretically linked to the inhibition-concept, like heart-rate variability or cortisol

levels are. Thirdly, if, as Kagan has suggested, inhibited individuals indeed represent a structurally different type, characterized by distinct interrelationships among fear of novelty, psychophysiological reactivity, and emotional reactivity, then we would expect to find different patterns of correlations between the inhibitionscores and scores on these other dimensions within the inhibited and the uninhibited group. Likewise, the patterns of correlations for the whole sample should not resemble the patterns within any of the subgroups. We will thus use scatter-plots to determine whether the correlation between variables of interest is actually produced by extreme groups, or appears similar over the range of the scores. For illustrative purposes we draw regression lines for the inhibited infants, the uninhibited infants, and the unspecified middle-group. If there are few if any mean differences, and largely similar correlation patterns, it would suggest that inhibition is not a categorical dimension.

Method.

58 infants were assessed at 5, 7, 10, and 13 months of age. Data were gathered on:

- physiological functioning (cardiovascular activity, salivary cortisol);
- emotional expressivity in response to several stimuli;
- maternal perception of the infant's temperament (ICQ);
- mother-infant interaction; and
- behavioral inhibition, attachment security, and dependency at 13 months of age.

Cardiovascular activity was measured at the beginning of each lab visit, and again after a series of stimuli had been presented. Heart period, heart period variability, and vagal tone were computed. Saliva was obtained by inserting a cotton swab into the infant's mouth at the beginning and end of the laboratory visit, as well as at home

when the infant awoke, and on another day at the same time as in the laboratory at each age. Preliminary analysis showed that the difference-score between the measurement in the laboratory and the measurement at home at the same time of day were most stable over the time period studied. Therefore we used this difference score in the analyses presented here.

The infant's emotional expressivity was assessed using AFFEX-coding from videotapes during a series of emotion-eliciting stimuli. Durations and latencies to reactions for positive and negative emotions were computed for each episode. Observations of mother-infant interactions were made during an hour-long home-visit using a 24-item behavioral checklist.

Attachment security and dependency were measured using Water's Attachment Q-set (sorted by mothers), and by correlating the sorts with a criterion sort for attachment and a criterion sort for dependency.

The inhibition-score was derived following the procedures described earlier, with standardization within episodes, excluding scores from episode 4, and measures of crying (which was not distributed normally).

Results.

Distribution of inhibition scores. With respect to the distribution of scores on the inhibition-composite, we see a distribution that is definitely not monomodal. However, the gap is not quite where we would expect it, as it discriminates 9 % rather than of 15 % of the sample. Closer inspection of the data indicates that the combination of duration-scores with latency-scores might be responsible for this. Since the duration of an episode is fixed, partially dependent scores, such as proximity and latency to approach, can produce very high values for some subjects when summed. For example, if an infant stays close to mother throughout an episode, the latency to approach the object will be at the maximum, too. The

distribution of the summary score as obtained using the inhibition procedure are thus inconclusive with regard to our question, and appear to be compatible with both the continuous and categorical perspectives.

[Figure 1 about here]

Group differences. The second question was to search for systematic group differences between the highly inhibited and the highly uninhibited infants. In order to statistically evaluate these differences, which are based on two relatively small subsamples (N1=9, N2=10), we used Mann-Whitney tests.

We found no differences in the levels of salivary cortisol, either in the early morning at home or either of the laboratory measurements, or the difference scores.

The picture is somewhat different for cardiovascular reactivity, however. Here, we did find differences between the extreme groups at 10 months, and near-significant results at 13 months, in both heart-period and vagal tone. In a surprisingly high proportion of our total sample, however, heart rate actually decreased during the laboratory procedures, and, therefore, we remain cautious when interpreting this finding. If the procedures are supposed to induce stress, this should be reflected in more than half of the sample! Moreover, the inhibited individuals were disproportionally likely to change in the "wrong" direction, with their heart rate actually decreasing.

Correlation patterns. As indicated earlier, we also computed correlations between the inhibition scores and the measures of emotional and psychophysiological reactivity in the whole sample as well as in the various subgroups. The correlations were computed for the complete sample, and then displayed as scatterplots. In those scatterplots, we inserted regression lines, computed for the three groups (inhibited, uninhibited, and unspecified middle) separately. Please keep in mind that the

correlations represent the whole sample, and the regressions cannot be expected to be stable, because the number of subjects is very small.

Fear of novelty (mothers report). Fear of novelty, as reported by the mothers in a temperament questionnaire, is conceptually very similar to behavioral inhibition as operationalized here. The correlations we found in our sample were disappointingly low, however, while reported fear of novelty was relatively stable over time. Moreover, the relationship between fear of novelty and behavioral inhibition was negative for the highly inhibited children, and positive for the low and middle group. Note also the large variation in reported fear of novelty especially in the low and middle group (see Figure 2).

[Figure 2 about here]

Although the negative relationship between fear of novelty and inhibition is constant over time for the inhibited infants, we do see a positive correlation for the middle group throughout. Under a continuous perspective, we would expect a postive correlation across the range of inhibition scores, and this expectation is clearly not what we found. However, we find the pattern also not supporting a discrete perspective, since the correlation for the inhibited infants is negative.

Emotions. Since behavioral inhibition is closely related to fear, we expected strong relationships between mothers' reports of the infants' fussiness and fearfulness, emotional expressions displayed during the eliciting task, and the scores obtained during the inhibition procedure. Accordingly, we found significant negative relationships between behavioral inhibition and positive emotions at 7, 10, and 13 months of age (r=-.21; r=-.26, and r=-.34, respectively). As figure 3 illustrates, however, the correlations were reasonably similar within all three groups. The correlations between behavioral inhibition and negative emotionality, the correlations

were r=.38, r=.20, and r=.01, at 7, 10, and 13 months of age, respectively. At 13 months, there were positive relationships in the high and low inhibition groups, but not in the middle one. On the other two occasions, the relationships were similar, as show in figure 4.

[insert Figures 3 and 4 here]

Dependency. Behavioral inhibition and dependency share some variance, but the correlation is moderate (r=.34, p<.05). From a conceptual point of view, this makes sense, as a child who becomes subdued in the presence of unfamiliar people or objects, will "cling" to mother more than those who are uninhibited. Indeed, the items on the Q-sort that index dependency prominently involve seeking proximity to mother in the presence of other people. In our sample security of attachment and dependency were completely independent. As the scatterplot indicates, the relationship between dependency and inhibition appears somewhat curvilinear, with higher dependency scores in the low and the high group, and a lower mean in the neutral group of the sample.

[Figure 5 about here]

Physiology. There was no relationship between the cortisol difference scores and behavioral inhibition. No regressions were calculated for the levels of cortisol because of several extreme values. The low, but significant correlation between the heart rate and inhibition scores, as well as between vagal tone and inhibition appears to be based on associations in the middle and high inhibition groups, with inconsistent findings in the low group. It remains unclear, however, why the

proportion of infants whose heart rate actually decreases during the visit in the laboratory is so high.

[insert Figures 6 and 7 about here]

Conclusion.

In sum, we have found very little evidence supporting a discrete perspective on behavioral inhibition as measured by the laboratory procedure. In those instances where we found patterns compatible with a discrete perspective, the direction of the correlations were the opposite of what we expected for the inhibited infants, leaving doubts about the meaning of these relationships. Most of the evidence presented in this paper appears to be compatible with a continuous perspective. We must remain cautious in our interpretation, however, since not all patterns are similar over the age range studied. Additionally, the small number of subjects in the subgroups also limits the reliability of our findings.

We conclude that if inhibition describes indeed a "type" of humans, we have reason to assume that the way we measure it in the laboratory does not fully reveal this disposition, but includes a variety of other concepts, some of them better known and defined in developmental psychology. Further research on the relationship between the concept of inhibition and dependency, emotional reactivity, and physiological reactivity is clearly needed, and special attention should be given to the operationalization of behavioral inhibition.

Table 1: Correlations between behavioral inhibition and Fear of Novelty.

	BEHINH	FEARNO7	FEARNO10	FEARNO13
BEHINH	1.0000	-.0764	-.1436	.2225
FEARNO7	-.0764	1.0000	.5372**	.4781**
FEARNO10	-.1436	.5372**	1.0000	.6517**
FEARNO13	.2225	.4781**	.6517**	1.0000

N of cases: 46
1-tailed Signif: * - .01 ** - .001

Table 2: Correlations between positive emotions and behavioral inhibition

	BEHINH	CP7	CP10	CP13
BEHINH	1.0000	-.2119	-.2626	-.3397*
CP7	-.2119	1.0000	.4098*	.1729
CP10	-.2626	.4098*	1.0000	.4390**
CP13	-.3397*	.1729	.4390**	1.0000

N of cases: 53
1-tailed Signif: * - .01 ** - .001

Table 3: Correlations between negative emotions and behavioral inhibition

	BEHINH	CN7	CN10	CN13
BEHINH	1.0000	.3833*	.1998	.0978
CN7	.3833*	1.0000	.3597*	.1595
CN10	.1998	.3597*	1.0000	.4969**
CN13	.0978	.1595	.4969**	1.0000

N of cases: 53
1-tailed Signif: * - .01 ** - .001

Table 4: Correlations between Heart Period Differences and behavioral inhibition.

	BEHINH	HPDI7	HPDI10	HPDI13
BEHINH	1.0000	-.0035	-.3308	-.1198
HPDI7	-.0035	1.0000	.1041	-.1642
HPDI10	-.3308	.1041	1.0000	.3398
HPDI13	-.1198	-.1642	.3398	1.0000

Minimum pairwise N of cases: 34
1-tailed Signif: * - .01 ** - .001

Table 5: Correlations between Vagal Tone Differences and behavioral inhibition.

	BEHINH	HVTDI7	HVTDI10	HVTDI13
BEHINH	1.0000	.0151	.1279	.1331
HVTDI7	.0151	1.0000	.0176	-.3822*
HVTDI10	.1279	.0176	1.0000	.2107
HVTDI13	.1331	-.3822*	.2107	1.0000

Minimum pairwise N of cases: 34

Measures in this study:

Behavioral Inhibition:

Episode	1 Free play	2 Stranger	3 Robot	4 Free play	5 Clown
Behavior					
Proximity to mother	X	X	X		X
Latency to play		X	X		X
Latency to approach		X	X		X

Composite formed on basis of standardized variables,
Cronbach's Alpha = .84,
Mean = .03, Min = -4.06, Max = 7.39

Cortisol difference score:
Measurement taken in the laboratory at the end of procedures
- Measurement taken at home at same time of day.

Heart period difference:
Measurement taken in the laboratory at the end of procedures
- Measurement taken before begin of procedures.

Vagal tone difference:
Measurement taken in the laboratory at the end of procedures
- Measurement taken before begin of procedures.

Dependency:
Q-correlation of 90-item version of Water's AQS (1987) with experts' dependency-sort.

Attachment security:

Q-correlation of 90-item version of Water's AQS (1987) with experts' security-sort.

Fear of novelty:

Composite formed using 2 or 3 items from the Infant Characteristics Questionnaire (ICQ, Bates, Freeland, & Lounsbury, 1979) and three additional questions, 7 point scales.

ICQ-Items: How does your baby typically respond to a new person? ... being in a new place? ... new playthings?

Additional Items: Does baby adjust within 5 minutes to new surroundings? What is your baby's initial reaction to new stimuli, food, people, places, toys, or procedures? How easy is it to modify infant's initial response?

Cronbach's alpha from .79 to .89

Maternal ratings of infant temperament:

ICQ-subscale Fussy/difficult

Cronbach's alpha from .77 to .84

Emotional expressivity:

Emotional responses to a series of stimuli (negative vs positive and social vs nonsocial) were coded using AFFEX (Izard & Dougherty, 1980). Composites were formed for standardized scores per stimulus for positive emotion (Duration and Latency to first display of Enjoyment/Joy), and negative emotion (Duration and latency to first display of Fear/Terror, Sadness/Dejection, Anger/Rage, or Disgust/Revulsion).

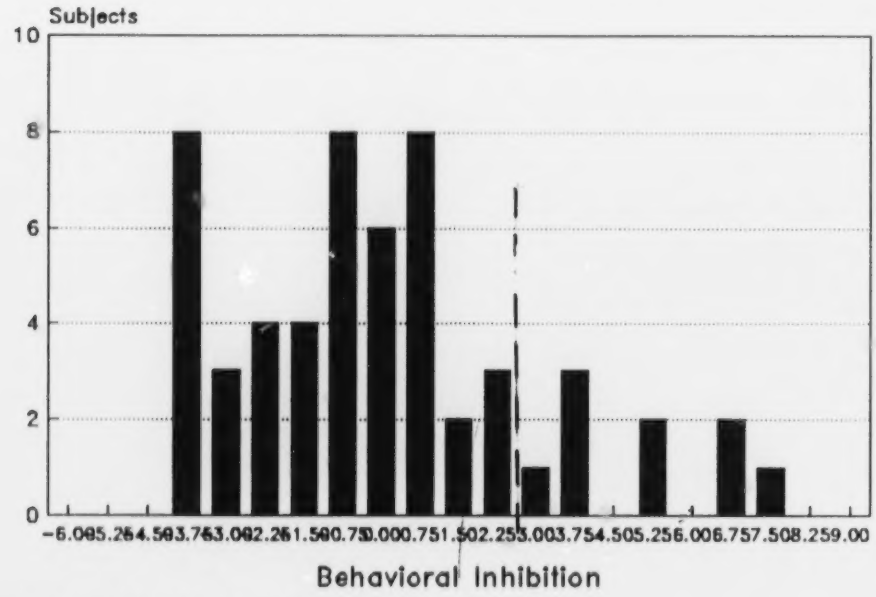
Cronbach's alpha from .80 to .84

Mother - infant interaction:

Harmony-score on basis of co-occurring adequate maternal and infant behaviors, observed with a 24-item checklist at 7 and 10 months of age.

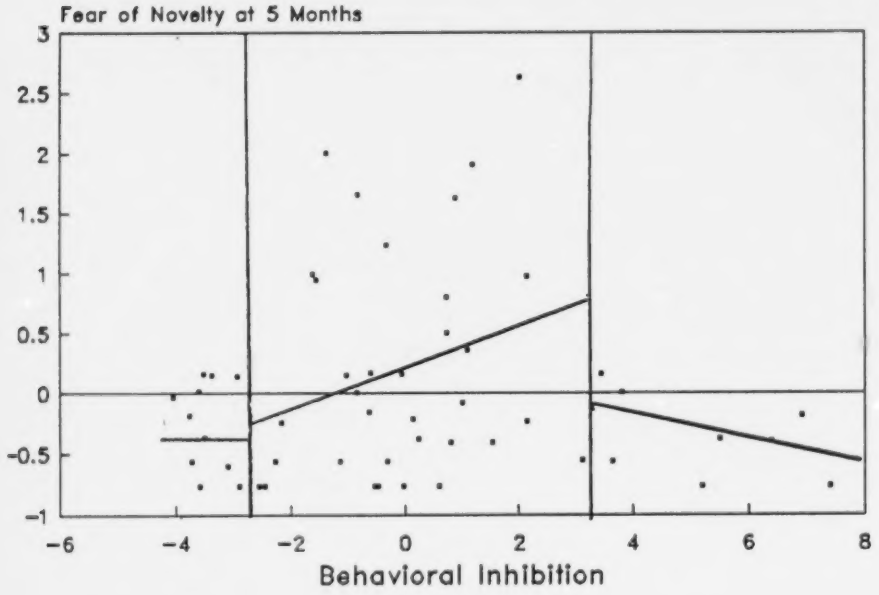
Fig. 1

Distribution of Inhibition Scores

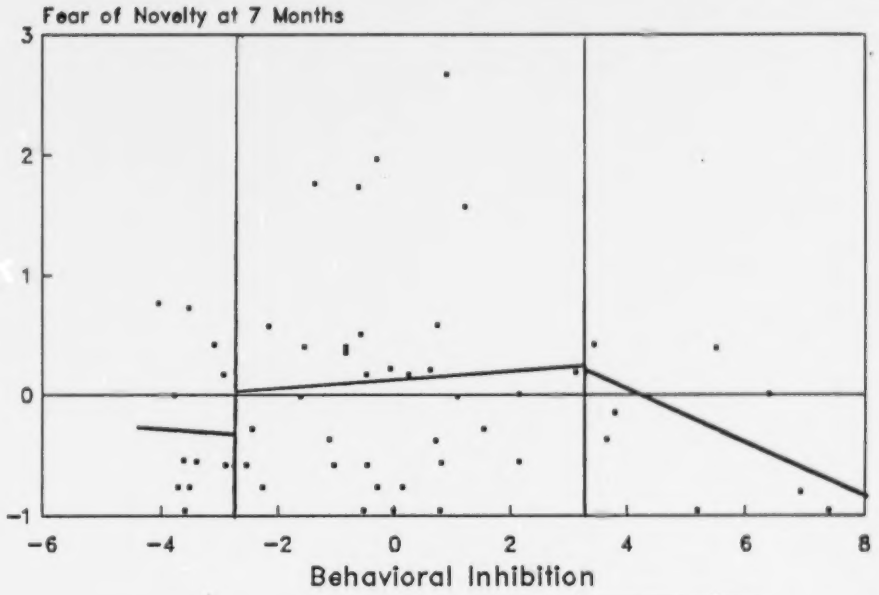


based on latencies and proximity - Fig 1

Inhibition and Fear of Novelty



Inhibition and Fear of Novelty



Inhibition and Fear of Novelty

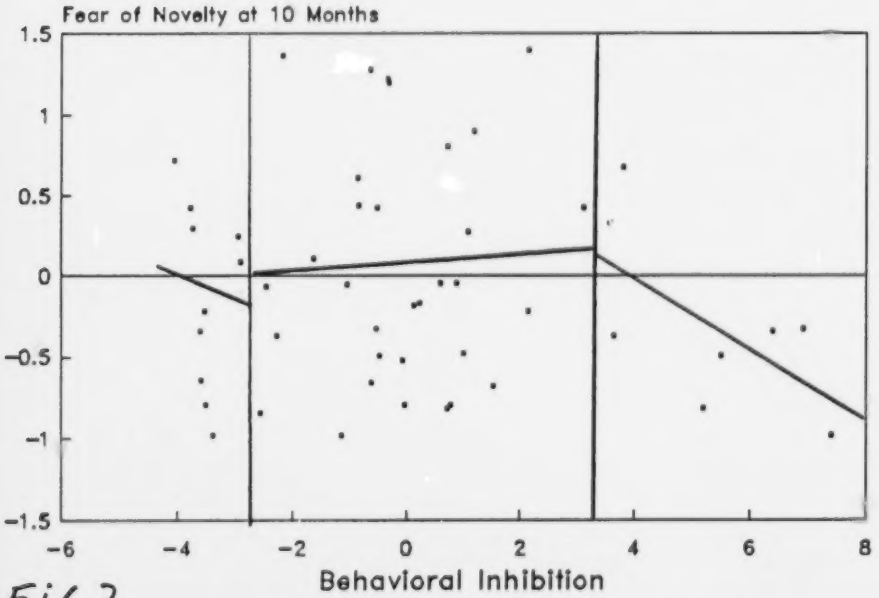


Fig 2

Inhibition and Fear of Novelty

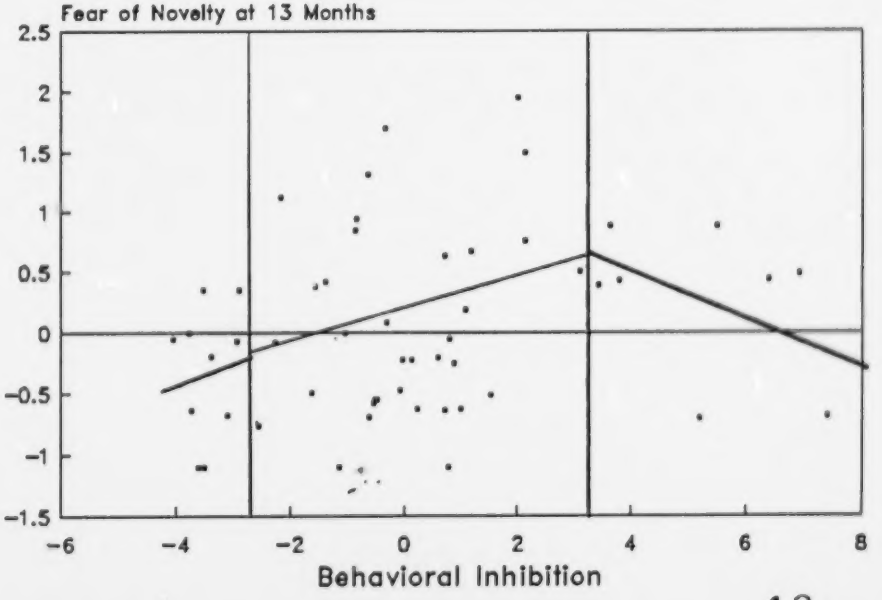
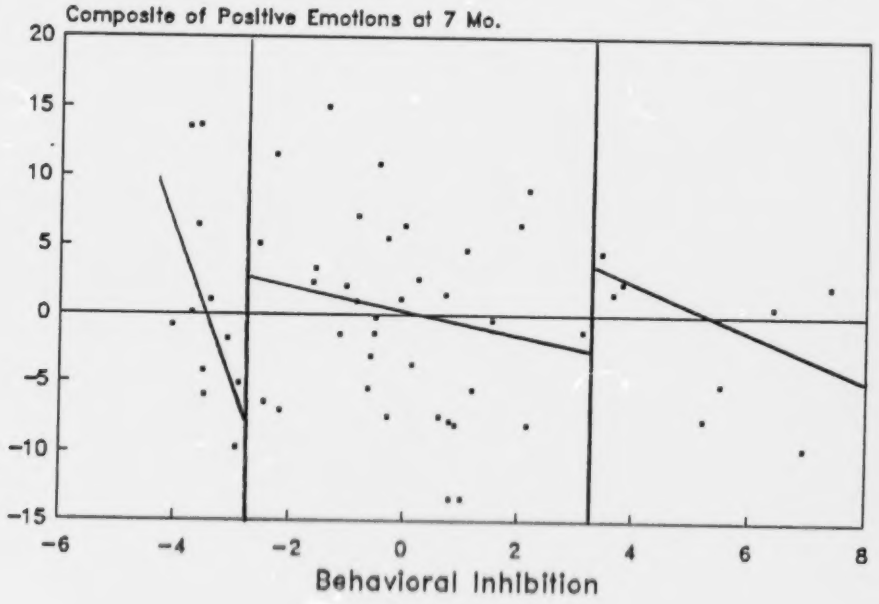
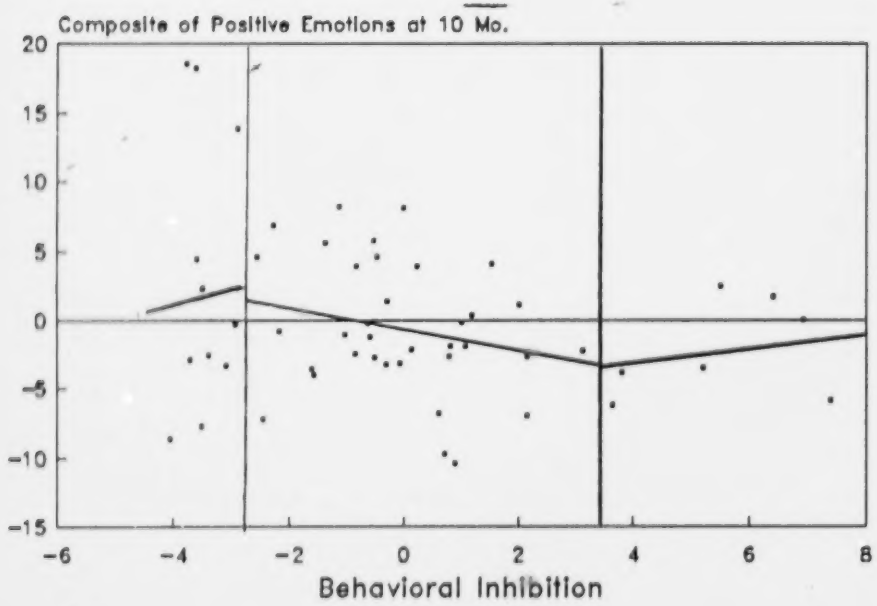


Fig 3

Inhibition and Positive Emotion





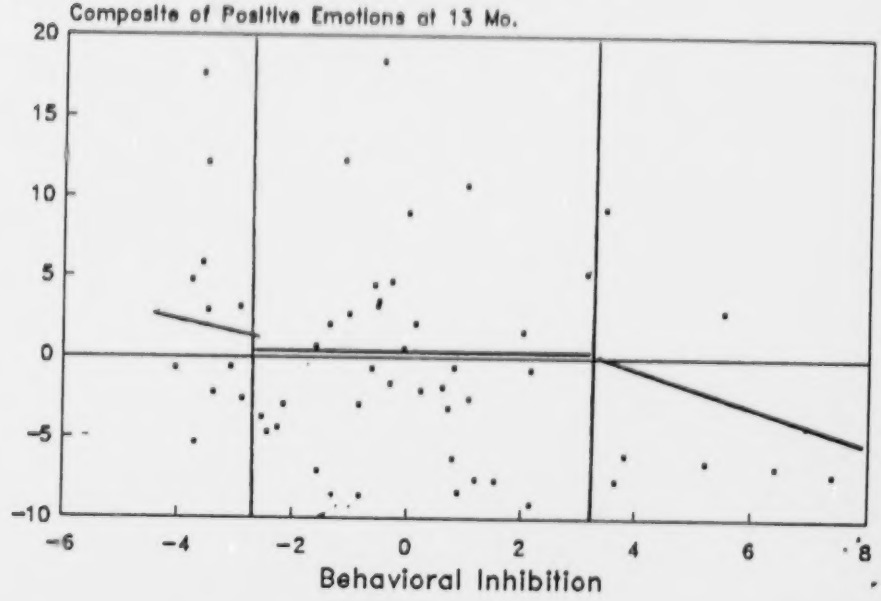
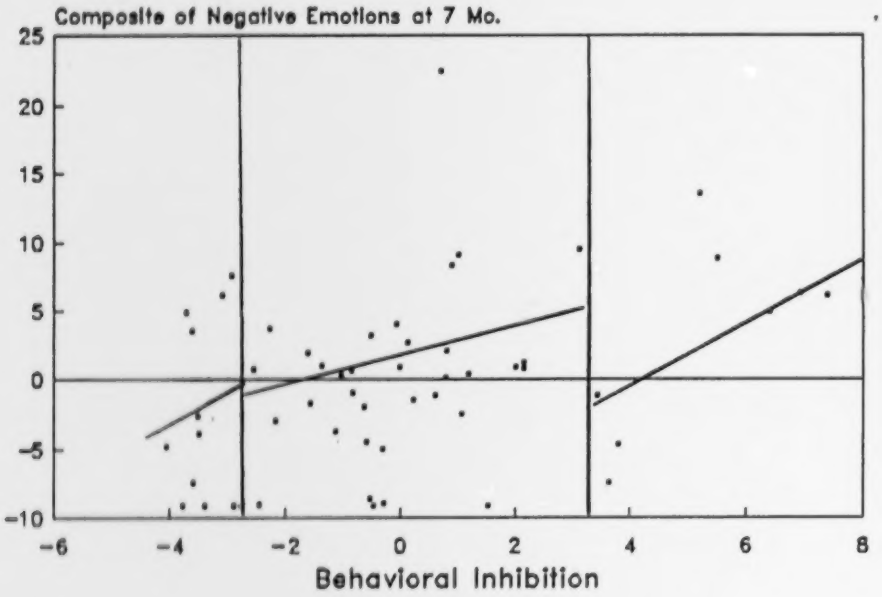
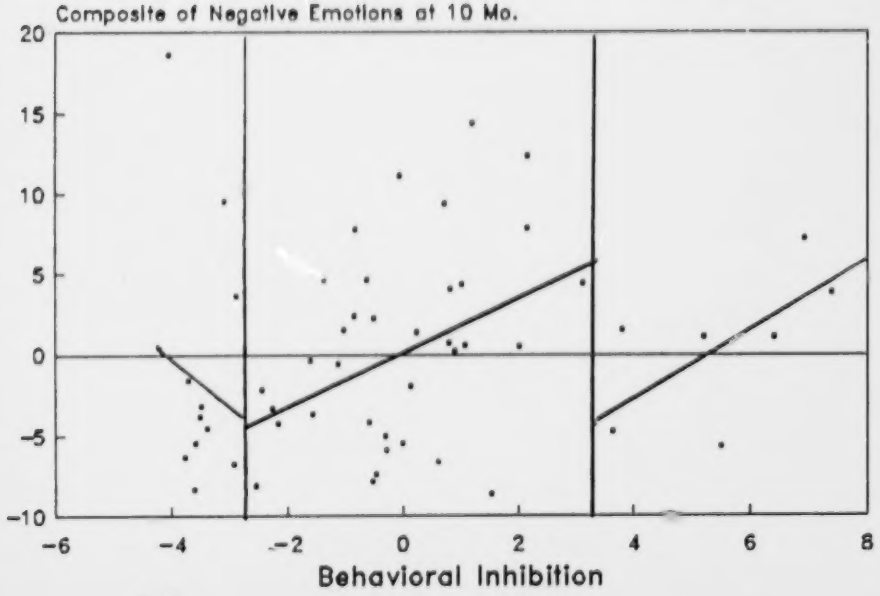
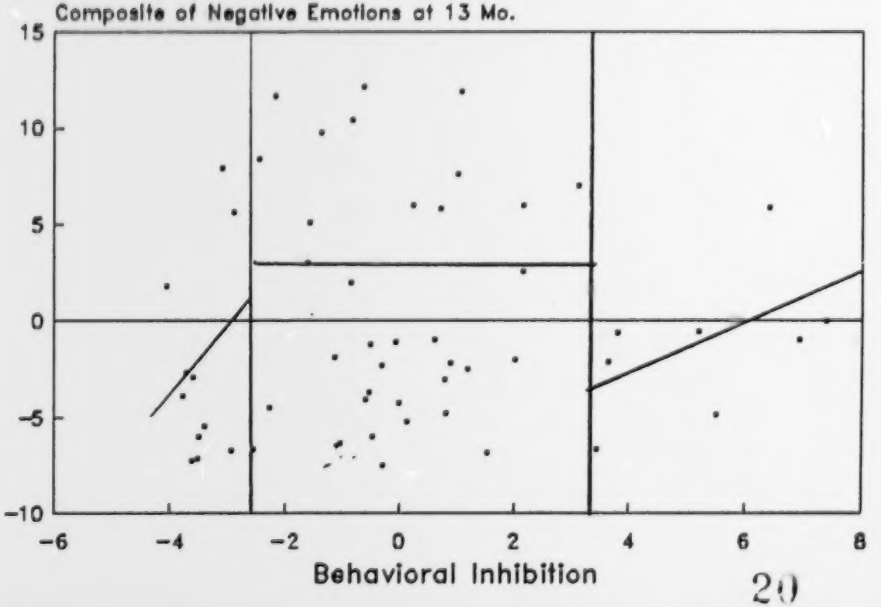


Fig. 4

Inhibition and Negative Emotion







Inhibition and Dependency
as measured by Q-Sort

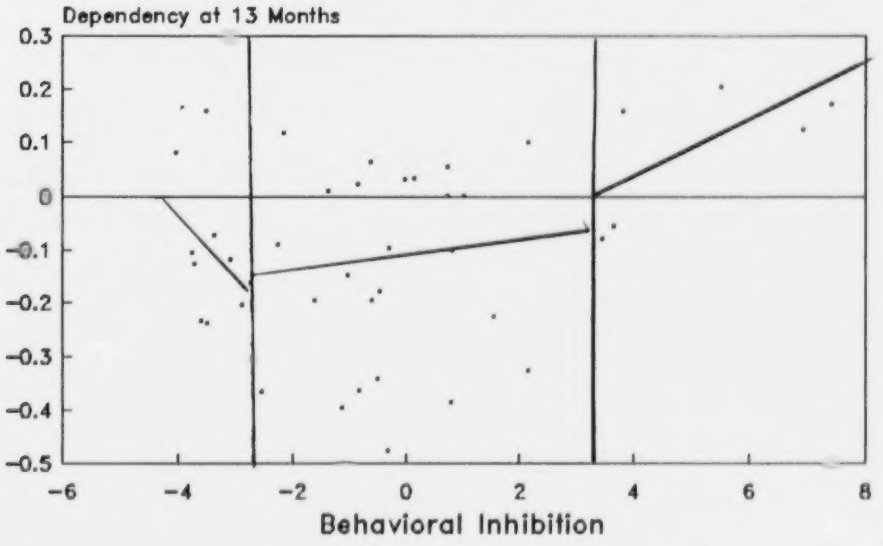
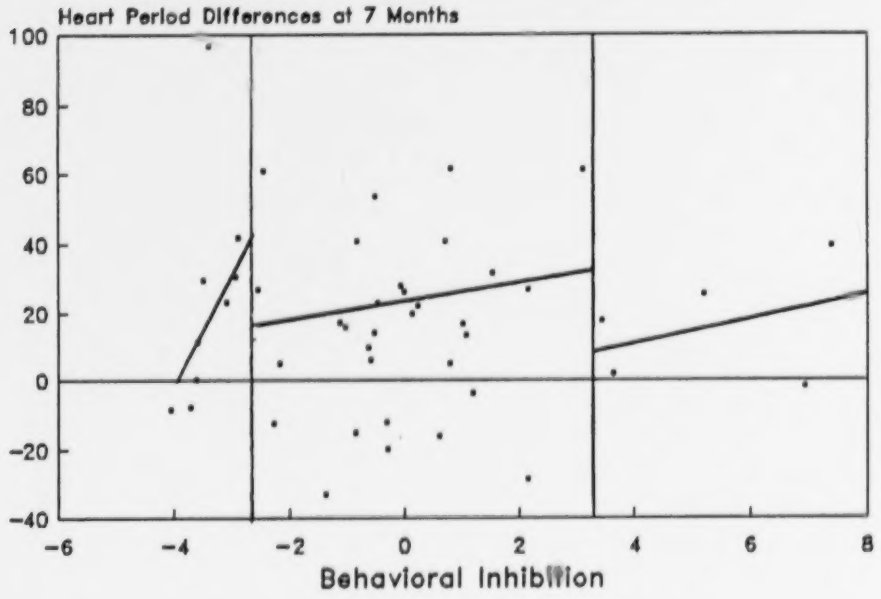


Figure 4

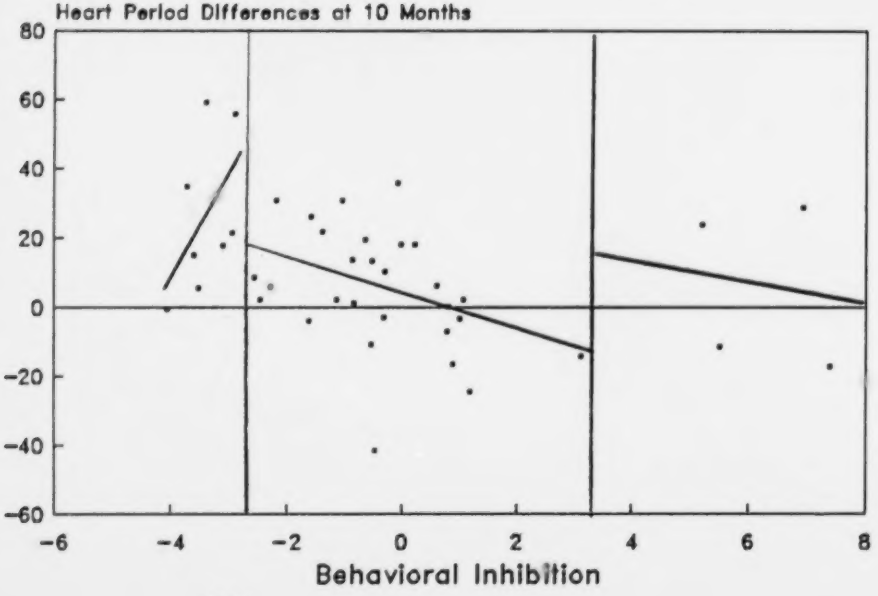
Fig 5

Fig. 6

Inhibition and Heart Period

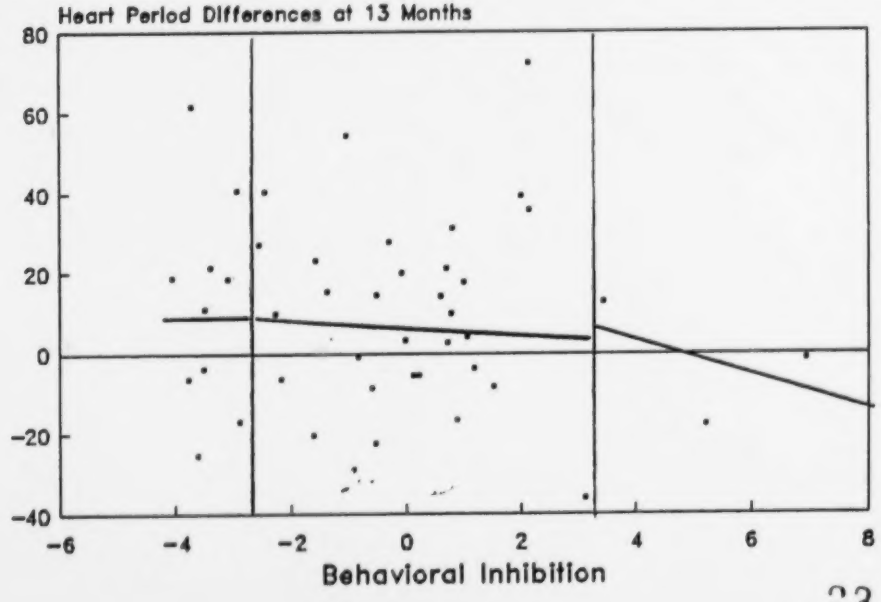


Inhibition and Heart Period



22

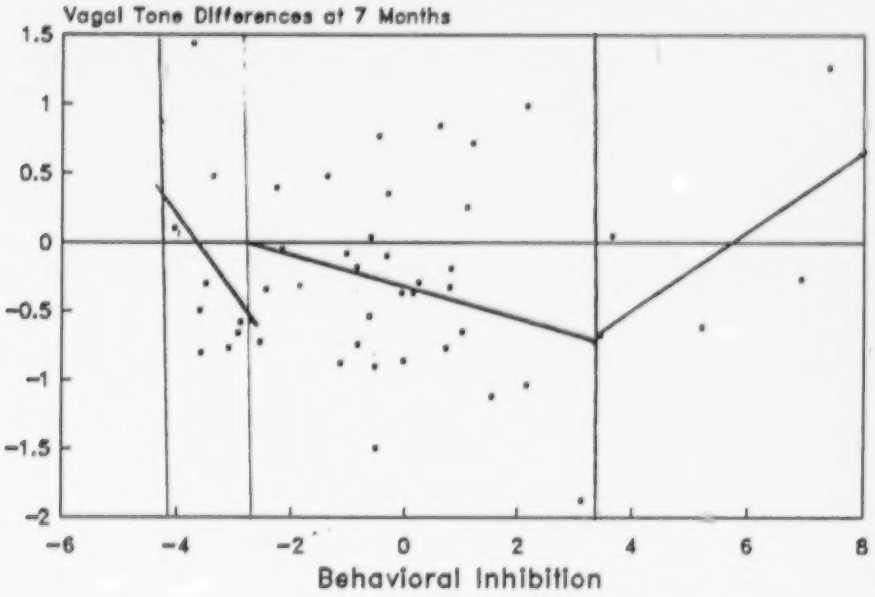
Inhibition and Heart Period



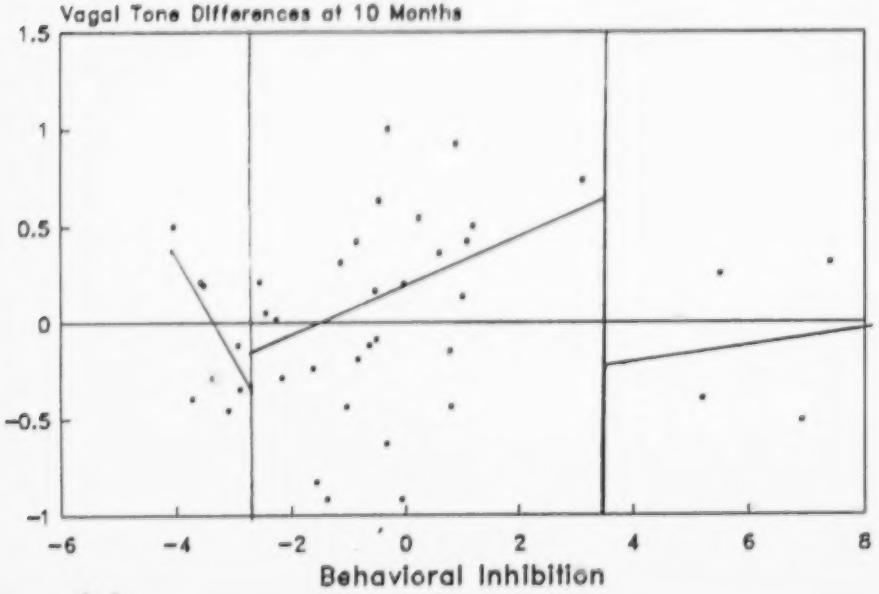
23

Fig 7

Inhibition and Vagal Tone



Inhibition and Vagal Tone



Inhibition and Vagal Tone